DCMS Future Telecoms Infrastructure Review: Call for Evidence

BT's response

January 2018

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This document covers BT's narrative response to the call for evidence. References to questions asked can be found in annex 1.

Executive summary

1. The UK is already a strongly performing digital economy, but it is vital that it has world-class next-generation digital infrastructure to build on that strong base.[1]

2. High-quality connectivity is a major factor in driving productivity and the competitiveness of the UK economy over the next decade and more. Digital services are increasingly central to all people and businesses and policy-makers should pursue a principle of universality – to make enhancements to digital networks as widely available as possible at reasonable cost.

3. This is a long-term project. For fixed networks in particular, the engineering task will be complex and time consuming – international comparisons show that only in Spain has it been possible to deploy fibre to more than 1m homes per year. Major investments are required. But, as the work of the National Infrastructure Commission and others has illustrated, the economics are challenging – with high fixed costs and significant uncertainty not only about deployment costs, but about consumer demand and the prices people will pay.

4. All of this uncertainty highlights the importance of this Review. The challenges are of a different nature and magnitude to those faced in the past decade, where investment was more incremental and costs not as large. This is a critical juncture; Government has the opportunity to create the right long-term policy framework to help mitigate this uncertainty and incentivise investment. Government is quite right to consider what is needed now to deliver investments that will span decades, and to bring a longer term perspective than the regulatory market reviews (which run in three year cycles).

5. To illustrate some of the policy choices, we have developed five market models. In particular, we look at models of infrastructure competition which are regulated (i.e. the current path in fixed markets), and those which are more market-driven (i.e. the current path in mobile markets), and compare these with models which underpin long-term investment through 'utility-like' regulation (with less emphasis on infrastructure competition).[2]

6. These models are not all mutually exclusive, and we are not seeking to promote any one of them as the policy solution. Nonetheless, it is clear to us that some may work better than others in terms of: (i) driving fast (but efficient) deployment at reasonable cost; (ii) feasibility of implementation; (iii) the relative contributions of private and public investment; and (iv) balancing the trade-offs between economic and social objectives (for example, between competition and universality, if the aim is to achieve wide coverage at similar national prices).

7. The current path in fixed markets (which we call "regulated infrastructure competition") combines regulation of the incumbent at multiple layers with proposed restrictions on it to meet competition, in addition to separate measures to support entry and expansion of network rivals. It may support deployment of full fibre in parts of the country that are commercially attractive, and competition

[1] The UK performs strongly as a digital economy. It belongs to the high performing cluster of countries as measured by the EU's Digital Economy and Society Index in 2017. UK citizens are well connected and are intensive users of online services and, for businesses, use of the cloud, ecommerce and social media is high. https://ec.europa.eu/digital-single-market/en/scoreboard/united-kingdom

[2] We also distil lessons from telecoms markets in other countries, and from other sectors in the UK.

will tend to drive efficiency and provide greater choice. But it cannot deliver a very wide roll out at similar prices between different geographies. Over time, different prices will tend to emerge geographically, given the lost opportunity to use a wide geographic presence to charge national prices which reflect average costs (i.e. to cross-subsidise between high and low cost areas). The sustainability of competition should also be considered given the high fixed cost economics of full fibre which make commercial cases difficult with existing competition, but even harder when there are multiple networks fighting for the same customers.

8. From our assessment of international comparisons, it is clear that no other country has achieved at-scale/at-pace deployment of FTTP (fibre to the premises, or 'full fibre') with a market model such as this. That is why we think this is the right time to consider alternative options, if the long-term aim is one of universality.

9. Our analysis considers a 'nominated regulated provider' model, which we believe could have the potential to attract significant investment capital and accelerate rollout of fibre in fixed markets. By preserving the option to cross-subsidise across customers in different geographic areas (as is currently the case), this model would also support the principle of universality.

10. As we expect competition to continue to be a feature of the UK market, we have also explored what other changes to the regulatory model could help investment and connectivity at the pace (and as widely) as the Government, industry and consumers would ideally want.

11. In particular, we think there is merit in exploring whether a more market-driven model of infrastructure competition could develop in fixed markets. Removing (or amending) regulation (where there is evidence of competitive pressure) could maximise the areas in which infrastructure competition is viable by providing greater flexibility for network rivals (including incumbents) to develop products, pricing, switchover models and risk-sharing deals to mitigate investment risk. This offers advantages over the existing model which inhibits this flexibility and tilts incentives away from investment– because it is more attractive for CPs to buy access to the incumbent's network at low prices than to build (or share risks).

12. In mobile markets, market-driven infrastructure competition has already delivered strong outcomes, particularly in combination with arrangements allowing certain fixed costs to be shared. Options for similar market-led collaborative solutions in fixed might emerge over time, but (as things stand) duct and pole access already facilitate asset sharing, and applications beyond this which retain the benefits of competition are not obvious.

13. A parallel – and important question – is how the non-economic areas of the country should be served given that infrastructure competition models will leave significant parts of the country unserved (although the scope for viable commercial provision is increased under a market-driven model). In general, these models will need more Government subsidy (or some other mechanism for sharing costs) because cross-subsidy by a single provider becomes less viable. For mobile, although the market model is well-established and functions well, Government support (particularly barrier-busting) will be required, as well as (potentially) different forms of collaboration between operators in some areas due to coverage or capacity issues.

14. Openreach – backed by the BT plc Board – has recently confirmed plans to connect 3m homes to FTTP. Openreach has also indicated an ambition to build a ten million FTTP footprint by the mid-2020s and, if the conditions are right, to go significantly beyond, bringing the benefits of FTTP to the majority of homes and businesses across the UK.

15. The pace and extent of this large-scale investment will depend on the extent to which (and how quickly) the conditions to enable an acceptable return on the investment are secured, including a

supportive regulatory and public policy framework. Specific enablers have been identified, in particular greater clarity around the fair bet framework to ensure that initial and subsequent rounds of investment have the opportunity to earn returns that fully reflect the risk taken at the time of investment, and where competition is effective, greater commercial freedom (i.e. a move towards the market-driven model). It is also important that the principles of such a supportive regulatory and public policy framework are clear and endure over the long term.

16. Even if this ambition is fulfilled, it still will not reach a significant proportion of UK households. A hybrid solution – applying different interventions and forms of regulation to different geographic markets – is likely to be required. Both the nominated provider model and the market-driven infrastructure competition model are compatible and consistent with Openreach's stated plans and ambitions.

17. Addressing the challenges relating to full fibre and 5G investment requires a collective effort as well as creative thinking from industry, policy-makers and regulators. Consumers will be interested in the end service they receive and not the technology that delivers it – it will be important to allow space for investment and innovation in a variety of different fixed and mobile technologies, with the aim of making the best services as widely available as possible, as quickly as possible.

18. BT will operate constructively within whatever policy and regulatory framework is decided upon. But we see this review as an important opportunity to identify a framework which will endure and be pursued transparently and predictably, enabling decisions on investment (by BT and other investors), that are inevitably long term in nature, to go ahead. We are supplying a range of detailed annexes alongside this response and stand ready to assist with any further research or analysis that Government would find helpful.

Demand uncertainties pose significant challenges for commercial large-scale (and long term) investment

19. There are significant demand uncertainties because new mass-market applications, services and ways of consuming them take time to emerge, and because demand can be met by existing technologies in the near term.

20. We can predict the characteristics of products and services that will become increasingly important (as set out below), but not the specific technology requirements, nor specific times when network enhancements will be required. These uncertainties are material to the investment case for full-fibre, and they are particularly pronounced for 5G; this poses materially different challenges for investors compared to the past, given the scale of investment required (tens of £billions), and the timescales involved (decades).

21. It is helpful, in the first instance to understand demand from the customer perspective, in particular, their behaviour, expectations and requirements. Demand can also be understood in terms of emerging use cases. There are also important social considerations. Consumer behaviour is constantly evolving, but we are expecting:

    - **wireless devices to be much more central** to how digital services are consumed;
    - **the ability to transition seamlessly from wired to wireless access to become a key customer requirement,** implying common services across different devices (in and out of the home);

- **greater emphasis on quality of experience**: businesses, for example, want ever more accessible and reliable connectivity in order to grow, reach target markets and streamline processes. Consumers also expect consistent and seamless quality wherever they are;
- **new use cases to emerge** (and become more important over time) and for them to drive demand in different ways. For example, the Internet of Things (IoT) will proliferate network end points and require low-power, low-latency solutions[3]; increased use of cloud applications is likely to drive demand for higher upload speeds and more symmetric services; use of digital applications for healthcare and education will also drive demand for availability, resilience and consistency. More advanced video-based applications will dominate usage in both fixed and mobile;
- **universality to be a central principle:** digital services are increasingly important in people's lives and no-one should be left behind. Universality objectives are critical, both in terms of access to digital content and services (not just at fixed locations), and the degree to which these services are available on broadly similar terms in different parts of the country.
- We set out further information on sources of demand in Annex 2.

22. What is clear from this description is that demand is not technology specific. Connecting this vision of the future with precise infrastructure and technology choices (and associated capital investments), therefore, is more difficult. But we do know that full fibre and 5G offer the characteristics that will become increasingly important to consumers and businesses, namely ubiquity, higher speeds, low latency and more reliable services. And we also think that creativity and flexibility in choice of technology solution is valuable, particularly in achieving universality objectives.[4]

23. We are less sure how quickly this demand will emerge, nor how it will translate into willingness to pay in order to support the required investment in enhanced services. There is little evidence that most customers are willing to pay a material premium for ultrafast speeds at this time. In Australia, where full fibre is already available to many customers, the uptake of speeds of even 50 Mbps is limited, and more than 80 per cent of end users choose a 25 Mbps speed tier or lower.

24. Customers will migrate to full fibre when they see additional value from doing so compared to what they already have; so the capabilities of existing (and enhanced) copper and cable[5]-based services and, in a converged world, 'fixed-like' 5G services matter. These will set a high threshold for full fibre to beat for quite some time, even with an ambitious view of potential use cases.[6]

25. Similarly, for 5G, investment will be required ahead of a clear understanding of full commercial opportunities, although Government-funded testbeds and trials will assist.

26. In a nutshell, uncertainties relating to demand pose significant challenges for commercial large-scale (and long-term) investment. Given the growing importance of ubiquity and reliability, the likelihood that investment will stimulate demand and the timescales involved, it is essential to consider

[3] For example, allowing automated interactions faster than human interactions with applications including cars, robotic manufacturing and drones, etc.

[4] For example where lower cost technology solutions offer the prospect of making otherwise un-economic areas to serve, economic.

[5] Hybrid copper and fibre based services.

[6] The work by Frontier Economics for NIC supports this, with G.Fast/DOCSIS being able to deliver "moderate evolution" in all years and "ambitious innovation" up to 2033. https://www.nic.org.uk/wp-content/uploads/Benefits-analysis.pdf, page 59.

alternatives to existing models which can facilitate (high fixed cost) investment ahead of demand. We explore below how different market models could achieve this.

Demand, supply and structural factors are relevant to an assessment of alternative market structures and policy frameworks

27. In addition to demand (which influences revenues), the commercial viability of step-change investments depends on deployment costs, which can vary by geography. The structure of the operator (and existing access regulation) is also important, as this determines how downstream benefits of investment are captured. Importantly, infrastructure competition (actual and prospective) will influence investment incentives in different ways: it potentially drives incentives if an operator risks becoming less competitive if it does not respond by investing; but it also makes investment more risky if returns are less predictable and visible when multiple network operators (and the retailers using these networks) are chasing the same customers.

28. We describe below investment challenges in the mobile and fixed sectors. We then set out the economic drivers relevant to these investments by reference to demand, supply and structural factors. This provides relevant context for our evaluation of market models (in the section below) each of which flexes these factors in different ways in order to improve the investment environment as compared to the status quo.

Mobile: investment needed in existing technologies and 5G

29. In the mobile sector, investment is needed in existing technologies (eg, 4G/LTE) to meet demand not currently served (or not well served), as well as in 5G technologies ahead of future demand. Key challenges include:

    - delivering good, reliable coverage wherever people live, work and travel, as well addressing coverage issues in specific locations with limited deployment options (eg, railways, underground and indoor);
    - delivering increased capacity and speeds in densely populated areas to meet escalating data-usage requirements (requiring the widespread deployment of small cells);
    - meeting the differentiated requirements of 5G applications as they emerge.

30. To meet these challenges, further investments will be required in existing infrastructure: sites, infrastructure (increasingly small cells), radio-access equipment, backhaul and spectrum, primarily by mobile network operators (MNOs). The nature and extent of these investments will depend on the existing configuration of assets and spectrum holdings for each MNO and their competitive strategy.

31. As regards the relevant demand, supply and structural factors underpinning these investments, we highlight the following:

    - **Vertical structure**: the four MNOs[7] are vertically integrated allowing all downstream benefits generated by new investment to be captured. Network services are sold (on a commercial wholesale basis) to mobile virtual network operators (MVNOs) who sell on to retail customers. This provides another option for monetising investments should this be

[7] There has been an evolution from two operators initially awarded licences for analogue services, to four after the initial 2G spectrum allocations in the early 1990s, with a fifth being encouraged into the market by the 2000 3G auction. The five vertically integrated mobile network operators (MNO), each with an independent network, became four operators after the merger of Orange and T Mobile (to create EE).

attractive (for example, where MVNOs offer an additional channel to market) but there is no regulatory obligation to do so.

- **Network sharing and other collaborations:** two networks have formed (once initial investments had been made in sites and radio equipment) by each MNO pairing with another to achieve better coverage while sharing network fixed costs.[8] Other collaborations include a degree of site sharing between all operators, ie, where CTIL acts as supplier to MBNL and vice versa, and sites operated by Arqiva[9] as well as models created for stadiums, airports and in-building.[10]
- **Infrastructure competition**: notwithstanding sharing arrangements, there is significant infrastructure competition between the four MNOs, which drives investment, because operators can differentiate in terms of different dimensions of network quality.[11]

32. MNOs are likely to remain central to meeting these investment challenges and the drivers and models for delivering investment (eg, competition between MNOs, coupled with infrastructure collaboration to reduce costs) will remain important whilst they continue to offer benefits.

33. However, further measures may be needed to improve the deployment environment (the planning process, for example) to address the specific challenges of coverage in very rural areas; as well as the deployment of small cells for 5G in areas of high footfall (urban areas, railway stations, the main transport corridors, for example).

Full fibre: business cases are long and risky

34. To date, fixed-access markets have seen primarily commercial investment, producing upgrades to cable and copper networks (competitively driven), alignment with user needs and anchor product regulation (ie, stability in legacy product pricing and pricing freedom for new NGA[12] products).

35. Full-fibre deployment is significantly different in a number of important respects:

- demand is highly uncertain for the reasons given above, and because the services available over existing (and potentially enhanced) technologies create a high threshold for full fibre to beat before significant migration will occur;
- the costs of large-scale deployment of full fibre are very significant and largely fixed: the National Infrastructure Commission (NIC) estimates capital costs of £26.5bn and 30-year (ie, lifetime) costs of £33.4bn (assuming UK-wide deployment of full fibre with some re-use of existing infrastructure, eg, ducts).[13] We estimate that this is approximately twice the total capital spend on the access network in the UK in the last 10 years from all players;
- build costs per premises are high and the deployment takes time. Unlike FTTC fixed networks or mobile networks, FTTP requires civil engineering activity for every premise

[8] Vodafone and O2 have formed "CTIL"; EE and Three have formed "MBNL"

[9] Wholesale Infrastructure Providers (such as Arqiva) act as intermediaries between landlords and MNOs (leasing land for sites and renting those sites to MNOs). They also build common infrastructure on sites which can then be shared between MNOs and other providers of radio based services.

[10] Various parts of the end to end solutions are also outsourced to common third parties which provide for service and infrastructure sharing; for example backhaul solutions offered by BT Wholesale; and field support (i.e. services to manage and operate the radio access network) offered by Ericsson (and smaller providers).

[11] More generally, operators try to differentiate themselves from their competitors in terms of price, coverage, speed, brand, handset availability, and other factors.

[12] Next Generation Access

[13] NIC estimates that costs are lower where a proportion of the deployment is replaced by either (i) fibre to 5G or (ii) fixed wireless access solutions.

passed by the network. The volume of work is high and labour intensive. In other European countries, only Spain has managed to deploy fibre to more than 1m homes each year[14], which further indicates the difficulty of rapid, at-scale deployment.

36. As regards the relevant demand, supply and structural factors underpinning these investments, we highlight the following:

    - **geographic variations in supply conditions**: the costs of a full-fibre build varies by region depending on type of housing, housing density, nature of the terrain and the proximity to, and quality of, existing infrastructure (particularly duct capacity).[15] Costs rise over the first ~20m of build before increasing sharply across the rest of the country. Commercial viability declines, therefore, as target deployment areas extend into lower density areas;
    - **asset sharing**: regulated access to Openreach's ducts and poles is being adapted to lower up-front costs of new network build;
    - **vertical structure**: network providers that are vertically integrated (such as Virgin Media) are able to realise all of the benefit from retail sales that they generate. The vertical structure also helps to mitigate demand risk because the downstream business is implicitly committed to support investment. Open access providers such as Openreach cannot realise all the retail benefit from an investment because some is captured by downstream providers who buy regulated access to the network. Equally, implicit commitments to support investment must be replaced by contractual commitments which may be difficult to secure;
    - **infrastructure competition**: can drive incentives to invest and offers benefits where rivals strive to win customers by offering better services than competitors. However, it can also make commercially viable investment more difficult given the sensitivity of investment cases to take-up assumptions. Demand for ultrafast services, which is already uncertain for the reasons outlined above, becomes even less certain in areas that are potentially contestable where rival infrastructure providers (and associated retailers) may be chasing the same few customers.

37. Given these factors, fixed markets divide into different geographic types with market structures potentially varying in different parts of the country. As discussed below, the evaluation of market models and regulatory/policy levers must recognise the implications of this.

An evaluation of market models should focus on their capability to deliver key social benefits

38. This review will test accepted assumptions and looks at investment drivers from all angles. In this spirit, we propose a framework for assessing different market models which identifies how they address the most important investment uncertainties, and whether they deliver key social benefits. The dimensions and key regulatory features of five models are described in Table 1 (at the end of this document).

39. Our evaluation focuses on the ability of these models to deliver important social benefits, namely: (i) accelerated deployment of full fibre and 5G across a wide geographic area; (ii) fair and affordable pricing; and (iii) efficient delivery and quality of service. International examples of these market models are provided together with a discussion of factors which have driven different market

[14] At a rate of approximately 1.6m homes per year.
[15] Costs incurred are also uncertain because they are a function of experience (learning by doing), scale and innovation.

outcomes. The detailed description and evaluation of the market models may be found in Annex 3; the international case studies are in Annex 4.

40. We highlight how certain models are more fit-for-purpose than others for delivering new investment at scale, in the context of significant uncertainty about demand, costs and technical solutions.

41. The extent to which policy and regulation can reduce these uncertainties will determine the scale and pace of the investment made. In particular, models which score highly are those where the form of competition that regulation (and the Government) seeks to support is clear; regulatory (and policy) levers are consistent and predictable in pursuing this objective, and appropriate for long-term investments; and are designed with the intention that they endure. Within such a framework, market-led solutions (and high-powered incentives) will emerge to address the inherent demand and supply side uncertainties.

A Government-led model is likely to be important whichever model is preferred

42. Before examining the market models in detail, we consider the role of the Government in supporting deployment in areas which are not likely to be commercial under any scenario. Options include long-term competitively tendered contracts (as under the existing BDUK regime).

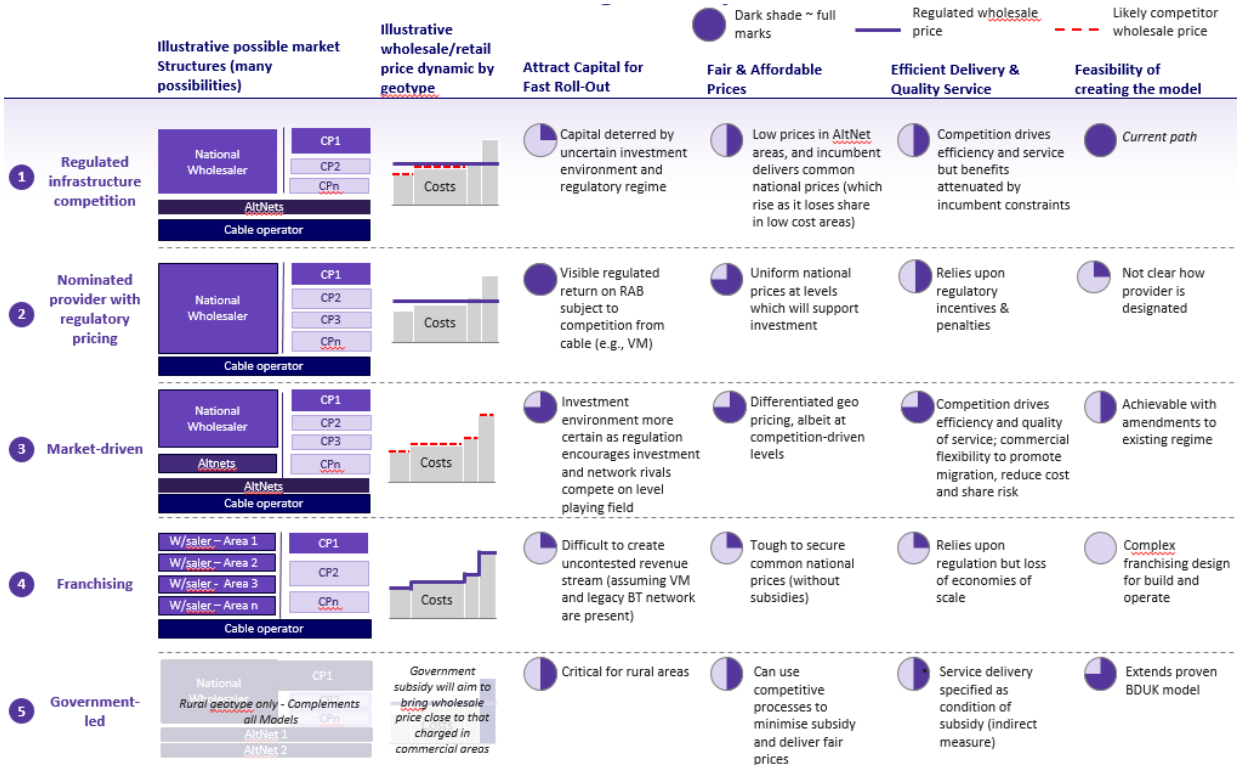
43. Providing public subsidy to support investment in remote, high cost, areas provides an alternative funding model to cross-subsidy, (i.e. where a provider with a wide coverage is able to meet the costs of serving customers in higher cost areas through margins earned in lower cost areas).

44. Cross-subsidy funding is compatible with Model 2 (nominated regulatory provider) but not the infrastructure competition models because cross subsidies will tend to unravel where competition removes volumes in lower cost areas from a provider which is using cross-subsidy to fund provision in higher cost areas. Where the option of funding universality objectives through cross-subsidy is lost, more is left to be done by taxpayers through public subsidy (or a sharing mechanism); this is a key trade off to highlight.

Ability to accelerate full fibre deployment, widely and at reasonable cost

45. We offer a view for each model on their ability to drive a fast (but efficient) deployment of full fibre at reasonable cost, as well as implementation feasibility.

Table 2: Overview of five market models evaluated against key societal criteria



46. The chart above highlights the following:

- Ability to attract capital and accelerate full fibre deployment: Model 2 (Nominated Regulated Provider) performs strongly because it creates a stable and predictable regime for earning returns on new investment. Model 3 (Market Driven) also performs well because regulation focuses on driving incentives to invest (or co-invest) - by reducing the costs of digging, and tilting incentives away from accessing Openreach's network. There is also a more level playing field between Openreach and network rivals in their ability to capture downstream benefits – for example more flexibility to strike risk sharing deals with retail providers and agree switchover. Model 1 (Regulated Infrastructure Competition), by combining aspects of Model 2 and Model 3, fails to achieve the benefits of either. The incentives to accelerate full fibre investment are compromised because low wholesale prices make buying access more attractive than building, and entrants face less certain market conditions.
- Fair and affordable prices: in each of the models, prices must support the investment in new technologies and increases in quality of services. However, there are key differences in how these costs are spread between customers. Model 2 (as noted above) allows national pricing based on an average of the costs in high- and low-cost 'geotypes', ie, there is a degree of cross-subsidy. However, the infrastructure-competition models are likely to evolve towards different geographic prices.[16] More generally, a more affordable price (whether in consumers' bills or taxpayer subsidy) is more likely where policy and regulation helps reduce the cost of financing through a transparent, consistent and predictable framework that supports investment.

[16] Albeit in model 1, this might be delayed for the incumbent by any restrictions on its ability to respond to local competition through geographic price changes.

- Efficiency and quality of service: for Model 2, efficiency and quality of service is driven through regulatory incentives and penalties. The infrastructure competition models (Models 1 and 3) would see competition (actual or potential) driving efficiency and quality (although Model 1, by hampering the ability of the incumbent to compete, is likely to perform less well than Model 3 which allows fair and full competition between network rivals.

47. Franchising (and other attempts to allocate territories to different infrastructure providers) do not score well on any metric. Franchising is a mechanism typically used to drive operating efficiencies for pre-existing assets (ie, where investment needs are minimal) and is difficult to construct effectively where build and operate phases are combined. It would be difficult (in UK fixed markets) to create a protected revenue stream to underpin a franchise (and drive investment incentives) where competition from cable, mobile and legacy infrastructure continues (unless the Government intervened to limit this competition). The model also begs questions about the treatment of assets at the end of the franchise, the answer to which would fundamentally affect bidding incentives and outcomes. Franchising would also result in a loss of economies of scale, and create complexities for communications providers (CPs) who wish to offer a national service but may have to interface with different network systems.[17] Other allocation rules give rise to similar problems (loss of economies of scale and interoperability complexities) and are fundamentally inconsistent with infrastructure competition.

Ability to support mobile enhancements and move to 5G scenarios

48. As indicated above, the market driven infrastructure competition and infrastructure collaboration models are already established in mobile markets and have delivered strong investment incentives. We expect these models to remain important whilst they continue to offer benefits.

49. However, there are challenges facing the mobile sector where these models work less well: (i) rural geographic coverage; (ii) capacity issues in densely populated hot-spots and (iii) the cost transformation required as hundreds of thousands of small cells (with power and backhaul) are deployed.

50. To address these issues, different forms of collaboration may be needed, with further interventions by the Government in non-commercial areas. Further policy support will also be required to enable a vibrant market for sites and lower the costs for deployment. This is needed for both existing large macro networks and also to enable the deployment of small cells at scale, by removing barriers and balancing the needs of telecoms infrastructure and other stakeholders.

51. More generally, it is important to consider full fibre models and 5G models in parallel; in particular, to consider how a policy framework can allow operators to best realise any synergies in order to further the national goals of full fibre deployment and international 5G leadership, for example:

    - Network planning and deployment synergies between FTTP and 5G to improve total capital efficiency and reduce total deployment times, such as coordinating new fibre backhaul for 5G with FTTP deployment plans, or co-deployment of fibre and small cells.
    - Fibre deployment to support 5G requirements of capacity, performance and hundreds of thousands of new small cells.

[17] An issue here is that a retailer may wish to offer a combination of services to consumers (e.g. voice, broadband, content, etc) and businesses (e.g. unified communications, security, etc) on a national basis but a comprehensive retail portfolio may be difficult where there are multiple infrastructures because of the complexities of making all of these services interoperable nationwide.

- Aligning fibre and in building mobile solutions to address both WiFi bottlenecks in fixed services and improve in building 5G services.
- Market-driven and infrastructure collaboration models may allow new business models to emerge for the development of end customer "fibre like" services, where mobile solutions could address costly FTTP areas – in the short term, enhanced 4G, and in the long term, 5G and mm wave.

Lessons from international case studies

52. There are lessons to be learnt from other countries but a simple read across is not possible because market outcomes reflect country-specific factors including, for example, network topology, housing density and demand.[18] As regards the factors central to this review (market models and associated regulatory and policy frameworks) there are some insights, as set out in Annex 4 and summarised below.

53. A number of themes emerge from a review of the regulatory and policy models used in countries where faster deployment of full fibre has been seen:

    - **intervention at only one level of the supply chain**: many countries have refrained from imposing wholesale access obligations on operators to incentivise full fibre deployment and allow a return on new investment;[19]
    - **a longer term framework**: a framework has been devised to give investors greater confidence of the regulatory approach that will apply beyond the review period relevant to *ex ante* regulation (for example, multi period charge controls in the Netherlands);
    - **more geographic differentiation**: competitive (and prospectively competitive)[20] markets have been distinguished from non-competitive markets and different regulatory models have been adopted in each (for example France and Spain have adopted a geographically segmented approach to regulation);
    - **more de-regulation**: greater reliance on *ex post* regimes often combined with dispute resolution arrangements rather than *ex ante* regulation (for example France and Germany);
    - **more Government funding**: the fibre investment plans in Australian and New Zealand both involved Government direction (in favour of full fibre)[21] and a significant degree of state

[18] Country-specific factors have been highlighted in several third-party reports. For example, a study for Ofcom by Analysys Mason in 2015 summarised key network factors which have underpinned technology choices between full fibre and FTTC as follows: the existence of street cabinets, the length of local loops, the availability and quality of ducts and housing density. Put simply, countries where street cabinets are widely available, local loops are short and ducts are not widely available (and in poor condition) have tended to favour FTTC over full fibre. FTTP economics are also more favourable in countries with a large share of the population living in multi-dwelling units (MDUs) and where labour costs are low. Demand conditions are also a relevant factor.

[19] Ofcom's Strategic Review notes the relationship between countries where there has been more emphasis on passive remedies and greater full fibre roll out (compared to the UK) https://www.ofcom.org.uk/__data/assets/pdf_file/0021/63444/digital-comms-review.pdf

[20] In some cases, markets have been defined as prospectively competitive based on indicators of prospective competition such as population density.

[21] This contrasts with Government intervention in Europe which has tended not to be linked with specific technologies. In the UK, for example, the 'win criteria' for BDUK contracts is specified by reference to the maximum number of premises at 30 Mbps for the lowest cost per premises, coupled with a target for the proportion of premises reached by a particular date. This has driven hybrid solutions in many areas

subsidy (around £500 per premises in New Zealand). Equally, in Singapore the Government supported the rollout through significant direct funding.

54. We have not identified a country which has seen at-scale and at-pace deployment of FTTP using a market model like the current UK version (a regulatory model which intervenes at multiple levels of the value chain and which is not differentiated by geography). Nor have we found a clear example of a country which has achieved significant full fibre penetration adopting the franchising model (or some other form of territorial allocation).

55. The market models correlated with the highest levels of fibre coverage have typically involved either nominated providers with significant Government assistance or market-driven models, in some cases incorporating different forms commercial infrastructure collaboration (for example, sharing of/co-investment in fibre connections into buildings in France). Even in countries with a significant proportion of full fibre, expansion into rural areas has been limited.

56. Brexit is likely to affect the international dimension of the UK policy debate. There are some risks – for example if access to funding for research and development (currently a major prompt to commercial innovation) were to disappear. There will also be an opportunity to reconsider the regulatory framework – for example to alter the cycle of regulatory reviews to provide greater certainty over investments; to underpin the independence of Ofcom as a regulator and to consider what checks and balances might sensibly apply to its decision-making once the European Commission no longer has a role in this regard.

BT Group and Openreach

57. A key objective of the Commitments given by BT was to ensure that Openreach gains more control of its strategy, investments and plans. In advance of the Commitments coming into effect, we have made changes to how Openreach is run, so it makes more of its own decisions, steered by an independent Board of experienced people from across industry.

58. Openreach continues to treat all customers equally, but new, and more transparent, ways of working with CPs are now in place. In particular, a new formal consultation process for major investments has been established including a confidential stage allowing customers to discuss ideas without this being disclosed to BT Group. The ongoing Openreach consultation on full fibre demonstrates how this has been applied. Openreach also has more freedom to consider co-investment and risk-sharing opportunities with other service providers.

59. These reforms are an important mechanism for ensuring that Openreach makes strategic decisions on infrastructure deployment which are most likely to meet the needs of CPs and end customers.

60. The market models identified above assume that the current Openreach governance model continues to exist. We note that a more market-driven model where Openreach has more freedom to negotiate risk sharing deals with wholesale customers, is consistent with the structure; indeed it was one of the benefits identified by Ofcom when the Commitments were agreed.

Public support may take the form of direct subsidy or indirect support to address specific barriers

61. We address Government support provided by way of public subsidy as part of our evaluation of market models. The review should also consider the existing (and other) mechanisms for providing Government support, and how they will need to evolve in line with the challenges outlined above. Fundamentally, there needs to be greater alignment of incentives across stakeholders involved in supporting investment in, and deployment of, digital infrastructure.

62. For example, the recent rise in business rates as applied to telecommunications assets is not supportive of full fibre investment despite the temporary rates relief offered. Openreach has highlighted that it is seeking the extension of Cumulo rates relief to better reflect the long-term nature of FTTP infrastructure investment timescales. More broadly there is still a material imbalance in the tax treatment between telecommunications and other utilities (for example with regard to VAT).

63. We are also concerned that the Annual Licence Fee (ALF) regime, as interpreted by Ofcom, places an undue additional financial burden on spectrum holders (beyond what is required to ensure efficient use of spectrum). This is particularly important given the significant, ongoing network investment required and challenges inherent in delivering good, reliable mobile coverage in ever more rural areas and in fulfilling the desire for early 5G deployment before future demand and use cases are fully understood. DCMS should therefore use this Review to fully consider the future ALF framework (particularly in light of Ofcom's forthcoming consultation) to ensure it does not act as an inappropriate brake on network investment.

64. Supporting measures aiming at reducing the cost of deployment both of mobile infrastructure as well as more fibre is critical, and we welcome the establishment of DCMS's barrier-busting task force. Important areas include: further reform of the planning regime across all parts of the UK; ensuring operators' access rights to land and infrastructure, set out by the new Electronic Communications Code, remain appropriate as we move into a 5G world; better access to public-sector assets for the deployment of digital infrastructure; further work to improve the process to obtain wayleaves and reform of current street works permit schemes and improvements in in-house wiring and ducting achieved via building regulations[22] (securing equal standing for telecommunications infrastructure and utilities). Co-ordination and sharing of expertise between central Government, local government and industry should be fostered to help establish best practice and more streamlined processes for site acquisition, in particular to facilitate the deployment of small cells for 5G.

65. Demand-stimulating measures may also help, including digital literacy or eGovernment initiatives and the consideration of the Government acting as an early adopter of 5G-based services to accelerate progress. Further down the line, the future evolution of DTT towards IPTV could also help to drive demand, as could the convergence of fibre and 5G.

Supporting DCMS in this review

66. BT is keen to take the opportunity presented by this review to work with the Government and Ofcom to identify a set of policy options to accelerate further the success of the UK's digital economy.

67. The following detailed annexes support this initial submission to the review:

    - Annex 1 provides answers to questions in the call for evidence as well as cross-referencing
    - Annex 2 sets out full-fibre and 5G future-use cases as well as our current understanding of demand and its likely evolution
    - Annex 3 describes and evaluates market models relevant to an assessment of investment incentives and long-term delivery of full fibre and 5G infrastructure
    - Annex 4 provides further detail on international case studies relevant to full-fibre deployment.

[22] Service issues can arise for reasons other than the quality of the access network due to, for example, inadequate home wiring and the effectiveness of the WiFi signal in all areas of the home. A cross-industry and government effort to improve the home environment would help realise the full benefits of an FTTP deployment.

68. In addition, we expect to provide further analysis in the form of additional annexes:

- details of the mobile network architecture in the UK as well as the market models and policies to address coverage, capacity and 5G challenges
- our suggestion of the policy measures required to support full fibre and 5G deployment.

Beyond the evidence we submit, we hope to play a full part in stimulating a full and open debate about the issues and choices across the industry in the months to come.

We would be happy to discuss these issues further. Further enquiries can be directed to David Pincott, head of political research, policy & briefing, BT Group

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Table 1: Summary of market models

Model	Description	Application in fixed (and examples)	Application in mobile (and examples)
Model 1: Regulated infrastructure competition	• There is infrastructure competition: actual and/or prospective • There is regulation to support entry/expansion by network rivals • There is regulation to support service-based, downstream competition; 'wholesale access' • Regulation is not geographically differentiated • Regulatory review periods are short (3 years)	• Regulated access to Openreach's ducts and poles • Openreach's freedom to respond to FTTP entry through pricing is restricted[23] • Regulated access to Openreach's network and electronics (with a charge control creating an anchor, constraining pricing of non-charge controlled products) • Openreach/BT invests at risk (subject to fair bet framework) • Openreach is regulated nationally • Market review periods are 3 years Examples: Status quo in UK fixed markets; no other examples in fixed telecoms markets	• Not applied in mobile markets
Model 2: Nominated regulated provider	• Infrastructure competition is limited • A provider of infrastructure is designated • There is regulation of prices and services to support service-based, downstream competition (e.g. RAB model) • Regulatory review periods are longer (5 years) • Could be regionally designated providers (to allow yardstick competition)	• Designated provider of large-scale, full fibre network • Regulated access to provider's network and electronics • Investment at risk, supported by regulated pricing and longer term regulatory framework • National pricing deploying cross-subsidy Examples: Singapore, New Zealand, Japan	• Not commonly applied in mobile markets

[23] Currently proposed by Ofcom

Model	Description	Application in fixed (and examples)	Application in mobile (and examples)

Model 3: Market-driven	• There is infrastructure competition: actual and/or prospective
	• There is regulation to support entry/expansion by network rivals (but focused on reducing rivals' costs not constraining incumbent)
	• Regulation to support service-based, downstream competition is removed or changed to tilt incentives towards investment
	• Regulation may be geographically differentiated (reflecting differing competitive conditions)
		• Regulation to support full and fair competition: (i) regulated access to Openreach's ducts and poles; (ii) Openreach has geographic pricing flexibility
		• No regulation of wholesale access in prospectively competitive areas; OR
		• Wholesale access regulation tilted towards supporting investment, eg,
		  o Long term certainty over fair bet
		  o Relax anchor constraints
		
		Examples: selected geographies in France, Portugal, Spain (until 2016), US.
			• Infrastructure competition between four credible wholesalers, each owning and operating their own infrastructure (albeit with network sharing to reduce costs)
			• No access-based regulation
			• Spectrum policy used to where necessary to maintain competitive provision
			
			Example: UK mobile markets

Model 4: Franchising	• Avoid infrastructure duplication by allocating specific network build and operate rights to specific geographies • Might use similar regulatory model as in Model 2	• The Government tenders the right to be the full fibre wholesale provider in defined (commercial) geographic areas or potentially imposes a "no overbuild" rule Example: cable in the UK	• Not applied in mobile markets
Model 5: Government led	• Covers a variety of models through which government may actively support investment in areas that would otherwise be uncommercial and remove barriers to deployment	• Direct subsidy to support rollout in uncommercial areas which will be needed to some extent for all models above	• Barrier busting (for example planning restrictions)